AIR HANDLING FACILITIES

at the

AMES LABORATORY

By R. W. Fisher, Ames

The Ames Laboratory installation is primarily concerned with two types of air handling: (1) a general type for supplying fresh air to the buildings proper and (2) special filtering centers for handling contaminated air from the various process areas.

SECTION 1 - General Air Supply for the Research Building

The air handling system in this building has recently been increased to handle 60,000 cfm fresh air at -20°F. The system was originally designed for 80% recycle of laboratory air to cut down on heating and air conditioning load. However, due to the number of hoods which are in operation throughout the building, it was necessary to increase our fresh air supply from 20,000 cfm to 60,000 cfm. The total air handling capacity is approximately 100,000 cfm.

The fresh and/or the recycled air is first passed through an oil-treated Farr filter, then through a bank of electrostatic filters and finally through carbon canisters which remove odors and other materials passing through the electrostatic filters. These carbon canisters are loaded with coconut-shell charcoal and have a life of approximately two years. We have found from operating experiences that these canisters must be given a protective coating to prevent corrosion. The estimated operating cost is approximately five cents per cfm per year. We believe that this cost is more than justified since it does permit the recycling of laboratory air which normally would not be permitted, resulting in a much lower operating cost both for steam in winter and chilled water in summer.

The air, after passing through the carbon canisters, goes across the heating or cooling coils, then through spray chambers which serve to cool or humidify, depending upon the requirements of the moment. The system is then divided into two zones with individual reheat coils at the duct entrances. In addition, each of these zones is sub-divided into a number of branch zones with additional reheat coils to permit balancing the system and altering temperatures for various areas. The building is kept under a positive pressure of approximately .02 to 0.1 inch of water by use of venturi dampers in the exhaust system.

SECTION 2 - Hot Canyon Air Handling System

This section of the Research Building is not air conditioned since the amount of air handled is too great to justify the cost. One hundred per cent of the air is discharged out of the stack. 15,000 cfm of air is brought in through a pre-filter consisting of a bank of Farr filters, then through a bank of deep-pocket FG-25 fiber glass filters. The air enters the Canyon through a perforated ceiling. All of the air is exhausted through the stainless steel cave and other dry box systems. This exhaust air is filtered through a bank of FG-25 deep-pocket filters, then through a bank of FG-50 deep-pocket filters and finally through a bank of CWS high-efficiency filters. The exhaust system consists of welded metal ductwork located outside the building proper extending up to the roof where it is discharged straight up into the atmosphere. The exhaust fan is powered by a two-speed, high-head blower, enabling the system to operate at the lower speed during shut-down times and in evenings when no work is being carried on. This maintains a negative pressure in the work area at all times preventing back-contamination.

In addition to the two-speed blower, an auxiliary, high-head, 6,000 cfm blower is installed in the line which serves as a safety factor in case the large motor should fail. With the above set-up it is possible for us to selectively discharge 6,000 cfm, 12,000 cfm, or 17,000 cfm depending on the needs of the moment. All of the Canyon exhaust system is further protected by an auxiliary power supply which cuts in automatically within four seconds in case of a power failure.

Monitoring devices have been placed in the filter system to enable us to check the activity of the filters and to remove them before the activity reaches a dangerous level. In case of an emergency, light weight diving suits have been provided to enable operating personnel to enter the filter chamber and remove highly active filters.

In addition to the gross air handling facilities, the air for each of the individual operations including glove boxes, etc., is prefiltered by a small CWS type filter before being discharged into the general system. By this method the general filter should run for a number of years before any maintenance and filter replacements will be required. In addition, the activity will be confined to a relatively small volume, aiding in the disposal.

SECTION 3 - Thorium Production

Approximately one year ago, the thorium production activity at the Ames Laboratory was shut down as a result of a survey which showed the dust levels to be abnormally high. As a result of this survey all of the process equipment was redesigned with a view toward reducing these levels to the tolerances prescribed.

In the oxalate precipitation step, the unloading of the thorium nitrate tetrahydrate is done by a closed system using a special hood which reduces the dust level in this area below tolerances. The area where the oxalic acid had been handled was completely hooded by a closed, plexiglass hood. A vent line terminating in a canopy was run to the rotary filter to pick up whatever dust might be generated from the damp filter cake. The hood, which is used to handle the wet and dry oxalate, was revamped by the addition of a pivoting plexiglass front, reducing the open area and thereby increasing the face velocity of the hood. A curb was placed on the front edge of the loading table to prevent powder from spilling onto the floor. As a further means of reducing dusting to the atmosphere, an enclosed grinder was installed in the hood through the work table surface, discharging into a sealed container below.

The rotary calciner was equipped with a vented hopper permitting drums of dry oxalate to be discharged into it with no leakage into the room. The discharge side was completely sealed by use of a pneumatic lift, permitting the oxide to go directly into a stainless steel drum in a closed system.

The off-gases of this process (approximately 70 cfm) at 550°C are filtered by means of a venturi scrubber utilizing a steam jet, and, thence, into the stainless steel cyclone separator. These hot gases are then additionally filtered through a heat-resistant, high-efficiency filter which is periodically cleaned and replaced. The efficiencies of the above system are as follows:

Cyclone separator alone gives approximately 80% efficiency by weight.

The addition of the steam spray and venturi scrubber brought the efficiency up to approximately 95% by weight.

The HF furnace is a new type not previously used at the time of the shut down. This continous furnace is loaded by means of a hopper similar to that used for the calciner and is discharged by means of an auger to a vented, five-gallon container. The off-gases, containing hot, wet HF, thorium oxide, and thorium fluoride, are passed through an inconel cyclone separator and then through a carbon filter with automatic blow-down feature. This system works quite well but requires considerable maintenance of the carbon filter. The HF is then condensed in a spray chamber and the acid solution is automatically neutralized with a sodium carbonate solution by means of a Beckman dipping electrode located on the discharge side. The effluent from this chamber is then discharged into the sanitary sewer system.

In addition to the above-mentioned equipment, all of the mixing and loading equipment used in the reduction step were given additional hoods which discharged first to a cyclone separator and then into a Type N roto-clone before being discharged outside the building. Air samples, which are taken periodically, show our dust levels to be low enough so as to present no problem to the surrounding areas. We feel that the process area, as a whole, was improved up to a point that the Ames Laboratory thorium operation could be very well carried out in a thickly populated community.

It is realized that improvements could be made to the above-mentioned equipment. However, since this was a crash program of a limited duration, it was felt that further work would be unnecessary and uneconomical.